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XVIII. *An Account of the State of the Thermometer at the Hague on the 9th of January 1757. Extracted from a Letter of Mr. Abraham Trembley, F. R. S. to Tho. Birch, D. D. Secret. R. S.*

Hague, Febr. 15. 1757.

Read Mar. 3, 1757. **I** Carefully observed the thermometer during the cold days, which we have had this winter. I made use of the same thermometer, with which I made my observations in 1740, and for that purpose fixed it in the same place, where it was that year, *viz.* in a window directly exposed to the north, and open to a large square. In 1740 I saw Fahrenheit's thermometer at two degrees below 0. This year, on the 9th day of January in the morning, it was at three degrees above 0; that is, only five degrees higher than in 1740.

XIX. *Experimental Examination of Platina.*
By William Lewis, M. B. F. R. S.

P A P E R V.

Read Mar. 17, 1757. **T**HE account of this extraordinary mineral, formerly read to this illustrious Society, and honoured with their approbation, being since published in the *Philosophical Transactions*,

actions, renders any recapitulation of the discoveries hitherto made unnecessary.

The near and remarkable relation betwixt platina and gold, not only in point of gravity, but in many less obvious properties, hitherto supposed to belong to gold alone; and their as manifest disagreement in others, particularly colour, ductility, and fusibility; induced me to examine, what effects they might have in combination with one another in different proportions; and whether there is reason to credit the report of great frauds having been committed by mixing them together; how far such abuses are practicable; and, what is of more importance, the means by which they are discoverable.

Experiments of the Mixture of Platina and Gold.

EXPERIMENT I.

1. Twelve carats * of fine gold, and the same quantity of the purer grains of platina, were urged in a blast-furnace, for near an hour, with a fire so strong, that a slip of Windsor brick, with which the crucible was covered, tho' defended by a thin coating of pure white clay, had begun to melt. Upon breaking the vessel, the metal was found in one smooth lump or bead; which, after being nealed by the flame of a lamp, and boiled in alum-water, appeared,

* The proportions were adjusted according to the carat weights, as it is by these, that the fineness of gold is usually expressed. A carat is the twenty-fourth part of the whole compound: thus gold of so many carats is a composition, of which so many twenty-fourths are fine gold, and the rest an inferior metal.

both

both in the mass, and upon the touchstone, of a pale bell-metal colour, without any resemblance to gold. It bore several strokes, and stretched considerably under the hammer, before it begun to crack about the edges. On viewing the fracture with a magnifying glass, the gold and platina appeared unequally mixed; and several small particles of the latter were seen distinct: nor was the mixture intirely uniform after it had again and again been returned to the fire, and suffered many hours of strong fusion.

2. Eighteen carats of gold and six of platina ($=3:1$) were melted together as the foregoing, in an intense fire continued about an hour. The bead, nealed and boiled, was less pale-coloured than the former, but had nothing of the colour of gold. It forged tolerably well, like coarse gold. To the naked eye it appeared uniform; but a good magnifier discovered in this, as well as in the other, some inequality of mixture, notwithstanding the fusion was two or three times repeated, with the strongest degrees of heat we were capable of exciting by large bellows.

3. Twenty carats of gold and four of platina ($=5:1$) were kept in strong fusion for above an hour and a half. These united into an equal mass, in which no granule of platina, or dissimilarity of parts, could be distinguished. The colour was still so dull and pale, that the compound could scarcely be judged by the eye to contain any gold. It hammered well into a pretty thin plate; but we could not draw it into wire of any considerable fineness.

4. Twenty-two carats of gold were melted in the same manner with two of platina ($=11:1$) the

same that standard gold contains of alloy. The mixture was uniform, of a tolerable golden colour, but easily distinguishable from that of standard gold by a dingy bell-metal cast. It worked well, was forged into a thin plate without cracking, and drawn into moderately fine wire.

5. Twenty-two carats and a half of gold, and one and a half of platina ($=15:1$), melted into an uniform mass, which, after the usual nealing and boiling, proved somewhat tougher than the preceding, and of a better colour.

6. Twenty-three carats of gold were melted with one of platina; which is nearly half the proportion, that standard gold contains of alloy. The compound worked extremely well, but was distinguishable from gold by a manifest dinginess, which it retained after repeated forgings, fusions, nealings, and boilings.

7. Twenty-three carats and one-fourth of gold, and three-fourths of a carat of platina ($=31:1$), formed an equal mixture, very malleable, ductile like the three foregoing whilst hot as well as cold, but not intirely free from their peculiar dingy colour.

8. A mixture of twenty-three carats and a half of gold, with half a carat of platina ($=47:1$), was very soft and flexible, of a good colour, without any thing of the disagreeable cast, by which all the foregoing compositions were readily distinguishable, in the mass as well as on the touchstone, from fine or standard gold.

9. A mixture of twenty-three carats and three-fourths of gold, with one-fourth of a carat of platina ($=95:1$), could not be distinguished by the eye or hammer from the fine gold itself.

In

In all these processes, even where the proportion of platina was small, the fusion was performed by a vehement fire, that the mineral might be the more intimately dissolved, and equally diffused thro' the gold. The necessity of this precaution appeared from an experiment formerly related; in which one of platina having been melted with four of gold, the button appeared not much paler than standard gold with silver alloy. On a second fusion it lost its yellow colour, which had at first been only external, from an imperfect mixture, great part of the platina being concealed in the internal part of the mass, and covered as it were by a golden coat.

The crucibles were rubbed on the inside with chalk, to prevent any particles of the metal from lodging in their cavities. A little borax was employed in each as a flux; with the addition of nitre, by which the colour of gold is somewhat heightened. On remelting some of the mixtures with sundry other additions, powdered charcoal seemed to improve the colour most.

EXPERIMENT II.

The preceding compositions, after being gently hammered and boiled, were weighed hydrostatically with great care, by a very tender balance, in distilled water, wherein the gravity of standard gold turned out 17.788.

All the mixtures proved heavier than standard gold. Their gravities were nearer to the medium of the gravities of the ingredients, than those of the compositions of platina with any of the other metals formerly

formerly given an account of; none falling considerably short of the mean gravity, and some rather exceeding it.

		Gravity.		Difference.	
		By Experiment.	By Calculation.		
Platina		17.000			
Platina	Gold 1	18.140	18.142	0. 02	} Diminution.
Platina	Gold 3	18.613	18.714	0.101	
Platina	Gold 5	18.812	18.904	0.092	
Platina	Gold 11	18.835	19.094	0.259	
Platina	Gold 15	18.918	19.142	0.224	
Platina	Gold 23	19.089	19.189	0.100	} Increase.
Platina	Gold 31	19.128	19.213	0.085	
Platina	Gold 47	19.262	19.237	0.025	
Platina	Gold 95	19.273	19.261	0.012	
Gold		19.285			

EXPERIMENT III.

As a mixture of platina with an equal quantity of gold has been reported to be specifically heavier than gold itself, but turned out otherwise in the above experiments; some further trials were made on that head.

1. Instead of the crude mineral, whose gravity is but 17, we took platina, that had been cupelled with lead, one of the neatest of the buttons formerly mentioned, which, tho' retaining a portion of the lead, was nearly as ponderous as fine gold, *viz.* 19.240. This was melted with equal its weight of the gold, in a strong fire, and continued in fusion for about an hour: the mass proved spongy, and very light. We

remelted it several times with vehement degrees of fire, suffering it to cool leisurely in the crucible; and, in order to separate as much as possible of the lead, to which its sponginess seemed owing, boiled it in aqua-fortis, and repeatedly injected corrosive sublimate upon it during fusion: the mass, nevertheless, still turned out cavernulous and brittle, and specifically lighter than either the gold or platina by themselves.

2. I likewise endeavoured to combine platina with small proportions of gold. By vehemence of fire, it was made to unite, tho' not perfectly, with half its weight and less: but the mixtures were extremely spongy and brittle; in specific gravity one scarce 16, another less than 15.

3. As a cast metalline body from the Spanish West Indies, of which some account will be given hereafter, appears to have been confounded with the mineral platina, this also was melted with an equal quantity of gold. They united with great ease, by a moderate fire, into an uniform compound, tolerably compact, but whose specific gravity was only $16\frac{1}{2}$; which is nearly the mean gravity of the two ingredients.

EXPERIMENT IV.

As a small portion of copper somewhat heightens the colour of pale gold, platina was melted with eight times its weight of standard gold made with copper alloy. The fusion was performed, as in the preceding experiments, in a close crucible, with a strong fire, but without any flux, and continued for about an hour. The metal appeared covered with a
black

black scurf, and had lost about $\frac{1}{700}$. It was much duller coloured, harder to the hammer, and cracked sooner about the edges, than mixtures of fine gold with a larger quantity of platina. By repeated fusion, and frequent nealing, it became a little softer and tougher, so as to be drawn into pretty fine wire; but the colour was still exceeding dull, more resembling that of bad copper than of gold.

The specific gravity of this compound was 17.915; a little less than the medium of the three ingredients unmixed, and a little greater than the mean gravity resulting from the platina by itself, and the copper and gold mixed; for copper, in the standard proportion, appears to diminish the gravity of gold more than it ought to do according to calculation.

From the foregoing experiments it appears, that platina is miscible with gold, in certain proportions, without injuring either its colour or ductility, or occasioning any considerable alteration in the gravity: experiments related in former papers have shewn, that it stands aqua-fortis, and the other trials by which the purity of gold is estimated. It is to be hoped, that the abuses manifestly practicable by this mineral have hitherto been but rarely made use of. To guard against them is the object of this paper; to detect them, of the next.